

Sub 17
2194. (amended) The method of claim 2193, wherein the one or more heaters comprise at least two heaters, and wherein superposition of heat from at least two heaters pyrolyzes at least some hydrocarbons within the part of the formation.

Sub 17
2195. (amended) The method of claim 2193, further comprising maintaining a temperature within the part of the formation within a pyrolysis temperature range.

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2196. (amended) The method of claim 2193, wherein at least one of the heaters comprises an electrical heater.

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2197. (amended) The method of claim 2193, wherein at least one of the heaters comprises a surface burner.

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2198. (amended) The method of claim 2193, wherein at least one of the heaters comprises a flameless distributed combustor.

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2199. (amended) The method of claim 2193, wherein at least one of the heaters comprises a natural distributed combustor.

2200. (amended) The method of claim 2193, further comprising controlling a pressure and a temperature within at least a majority of the part of the formation, wherein the pressure is controlled as a function of temperature, or the temperature is controlled as a function of pressure.

Sub 27
2201. (amended) The method of claim 2193, further comprising controlling the heat such that an average heating rate of the part of the formation is less than about 1 °C per day during pyrolysis.

2202. (amended) The method of claim 2193, wherein providing heat from one or more of the heaters to at least the portion of formation comprises:

Sub E7
heating a selected volume (V) of the coal formation from one or more of the heaters, wherein the formation has an average heat capacity (C_v), and wherein the heating pyrolyzes at least some hydrocarbons within the selected volume of the formation; and

D3
wherein heating energy/day (P_{wr}) provided to the selected volume is equal to or less than $h \cdot V \cdot C_v \cdot \rho_B$, wherein ρ_B is formation bulk density, and wherein an average heating rate (h) of the selected volume is about 10 °C/day.

Sub E5
D4
2204. (amended) The method of claim 2193, wherein providing heat from one or more of the heaters comprises heating the part of the formation such that a thermal conductivity of at least a portion of the part of the formation is greater than about 0.5 W/(m °C).

D5
2219. (amended) The method of claim 2193, further comprising controlling a pressure within at least a majority of the part of the formation, wherein the controlled pressure is at least about 2.0 bar absolute.

Sub E17
D6
2224. (amended) The method of claim 2193, further comprising:
providing hydrogen (H_2) to the heated part to hydrogenate hydrocarbons within the part;
and
heating a portion of the part with heat from hydrogenation.

Sub G7
D7
2226. (amended) The method of claim 2193, further comprising increasing a permeability of a majority of the part of the formation to greater than about 5 Darcy.

Sub E6
D7
2227. (amended) The method of claim 2193, wherein allowing the heat to transfer comprises increasing a permeability of a majority of the part of the formation such that the permeability of the part is substantially uniform.

Sub G1
D8
2229. (amended) The method of claim 2193, further comprising producing a mixture in a production well, wherein at least about 7 heaters are disposed in the formation for each production well.

SubG17 ~~2230~~ (amended) The method of claim ~~2193~~, further comprising providing heat from three or more heaters to at least a portion of the formation, wherein three or more of the heaters are located in the formation in a unit of heaters, and wherein the unit of heaters comprises a triangular pattern.

~~2231~~ (amended) The method of claim ~~2193~~, further comprising providing heat from three or more heaters to at least a portion of the formation, wherein three or more of the heaters are located in the formation in a unit of heaters, wherein the unit of heaters comprises a triangular pattern, and wherein a plurality of the units are repeated over an area of the formation to form a repetitive pattern of units.

SubE1 ~~2232~~ (amended) A method of treating a coal formation in situ, comprising:
providing heat from one or more heaters to at least a portion of the formation; and
allowing the heat to transfer from one or more heaters to a part of the formation to increase a permeability of a majority of at least a portion of the part of the formation such that the permeability of the majority of the part is substantially uniform.

SubE1 ~~2233~~ (amended) The method of claim ~~2232~~, wherein the one or more heaters comprise at least two heaters, and wherein superposition of heat from at least two heaters pyrolyzes at least some hydrocarbons within the part of the formation.

SubG17 ~~2234~~ (amended) The method of claim ~~2232~~, further comprising maintaining a temperature within the part of the formation within a pyrolysis temperature range.

~~2235~~ (amended) The method of claim ~~2232~~, wherein at least one of the heaters comprises an electrical heater.

~~2236~~ (amended) The method of claim ~~2232~~, wherein at least one of the heaters comprises a surface burner.

Sub 17 ⁴³ 2237. (amended) The method of claim 2232, wherein at least one of the heaters comprises a flameless distributed combustor.

⁴⁴ 2238. (amended) The method of claim 2232, wherein at least one of the heaters comprises a natural distributed combustor.

2239. (amended) The method of claim 2232, further comprising controlling a pressure and a temperature within at least a majority of the part of the formation, wherein the pressure is controlled as a function of temperature, or the temperature is controlled as a function of pressure.

D8 2240. (amended) The method of claim 2232, further comprising controlling the heat such that an average heating rate of the part of the formation is less than about 1 °C per day during pyrolysis.

Sub E87 2241. (amended) The method of claim 2232, wherein providing heat from one or more of the heaters to at least the portion of formation comprises:

heating a selected volume (V) of the coal formation from one or more of the heaters, wherein the formation has an average heat capacity (C_v), and wherein the heating pyrolyzes at least some hydrocarbons within the selected volume of the formation; and

wherein heating energy/day (Pwr) provided to the selected volume is equal to or less than $h \cdot V \cdot C_v \cdot \rho_B$, wherein ρ_B is formation bulk density, and wherein an average heating rate (h) of the selected volume is about 10 °C/day.

Sub E97 D9 2243. (amended) The method of claim 2232, wherein providing heat from one or more of the heaters comprises heating the part of the formation such that a thermal conductivity of at least a portion of the part of the formation is greater than about 0.5 W/(m °C).

DP SubG1 2258. (amended) The method of claim 2232, further comprising controlling a pressure within at least a majority of the part of the formation, wherein the controlled pressure is at least about 2.0 bar absolute.

SubG1 2263. (amended) The method of claim 2232, further comprising:
providing hydrogen (H₂) to the heated part to hydrogenate hydrocarbons within the part;
and
heating a portion of the part with heat from hydrogenation.

SubE12 2265. (amended) The method of claim 2232, wherein allowing the heat to transfer comprises increasing a permeability of a majority of the part of the formation to greater than about 100 millidarcy.

SubG1 2267. (amended) The method of claim 2232, further comprising producing a mixture in a production well, wherein at least about 7 heaters are disposed in the formation for each production well.

2268. (amended) The method of claim 2232, further comprising providing heat from three or more heaters to at least a portion of the formation, wherein three or more of the heaters are located in the formation in a unit of heaters, and wherein the unit of heaters comprises a triangular pattern.

2269. (amended) The method of claim 2232, further comprising providing heat from three or more heaters to at least a portion of the formation, wherein three or more of the heaters are located in the formation in a unit of heaters, wherein the unit of heaters comprises a triangular pattern, and wherein a plurality of the units are repeated over an area of the formation to form a repetitive pattern of units.

SubE12 5081. (amended) A method for treating hydrocarbons in at least a portion of a coal formation, wherein the portion has an average permeability of less than about 10 millidarcy, comprising:

~~SUB 127~~ providing heat from one or more heaters to the formation;
allowing the heat to transfer from one or more heaters to a part of the formation such that heat from the heaters pyrolyzes at least some hydrocarbons within the part of the formation, and wherein heat from the heaters increases the permeability of at least a portion of the part of the formation; and
producing a mixture comprising hydrocarbons from the formation.

5082. (amended) The method of claim 5081, wherein the one or more heaters comprise at least two heaters, and wherein superposition of heat from at least two heaters pyrolyzes at least some hydrocarbons within the part of the formation, and wherein superposition of heat from at least two heaters increases the permeability of at least the portion of the part of the formation.

~~D14~~
~~SUB 127~~ 5083. (amended) The method of claim 5081, further comprising allowing heat to transfer from at least one of one or more of the heaters to the part of the formation to create thermal fractures in the formation wherein the thermal fractures substantially increase the permeability of the part of the formation.

~~SUB 127~~ 5084. (amended) The method of claim 5081, wherein the heat is provided such that an average temperature in the part of the formation ranges from approximately about 270 °C to about 400 °C.

~~SUB 127~~ 5085. (amended) The method of claim 5081, wherein at least one of the heaters comprises an electrical heater located in the formation.

~~SUB 127~~ 5086. (amended) The method of claim 5081, wherein at least one of the heaters is located in a heater well, and wherein at least one of the heater wells comprises a conduit located in the formation, and further comprising heating the conduit by flowing a hot fluid through the conduit.

~~SUB 127~~ 5087. (amended) The method of claim 5081, wherein at least some of the heaters are arranged in a triangular pattern.

5/5 Sub 1797 74
5090. (amended) The method of claim 5081, wherein the pressure is controlled such that pressure proximate to one or more of the heaters is greater than a pressure proximate to a location where the fluid is produced.

Sub 1797 D16
5150. (amended) A method of treating a coal formation in situ, comprising:
providing heat from one or more heaters to at least a portion of the formation;
allowing the heat to transfer from one or more heaters to a part of the formation such that a permeability of at least a portion of the part of the formation increases, and is greater than about 100 millidarcy; and
controlling formation conditions to produce a mixture from the formation, wherein a partial pressure of H_2 within the mixture is greater than about 0.5 bars absolute.

5151. (amended) The method of claim 5150, wherein the one or more heaters comprise at least two heaters, and wherein superposition of heat from at least two heaters pyrolyzes at least some hydrocarbons within the part of the formation.

Sub 1797 45 43
5152. (amended) The method of claim 5150, further comprising maintaining a temperature within the part of the formation within a pyrolysis temperature range.

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5153. (amended) The method of claim 5150, further comprising controlling a pressure and a temperature within at least a majority of the part of the formation, wherein the pressure is controlled as a function of temperature, or the temperature is controlled as a function of pressure.

5154. (amended) The method of claim 5150, further comprising controlling the heat such that an average heating rate of the part of the formation is less than about 1 °C per day during pyrolysis.

Sub 1797 D17
5156. (amended) The method of claim 5150, wherein providing heat from one or more of the heaters comprises heating the part of the formation such that a thermal conductivity of at least a

~~SUB 17~~
~~D17~~
portion of the part of the formation is greater than about $0.5 \text{ W/(m}^2\text{C)}.$

~~SUB 17~~
~~D18~~
5169. (amended) The method of claim 5150, further comprising controlling a pressure within at least a majority of the part of the formation, wherein the controlled pressure is at least about 2.0 bar absolute.

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~~D19~~
5172. (amended) The method of claim 5150, wherein allowing the heat to transfer comprises increasing a permeability of a majority of the part of the formation such that the permeability of the majority of the part is substantially uniform.

~~SUB 17~~
~~D20~~
5174. (amended) The method of claim 5150, further comprising producing a mixture in a production well, wherein at least about 7 heaters are disposed in the formation for each production well.

~~SUB 17~~
~~D21~~
5175. (amended) A method of treating a coal formation in situ, comprising:
providing heat from one or more heaters to at least a portion of the formation;
allowing the heat to transfer from one or more heaters to a part of the formation such that a permeability of at least a portion of the part of the formation increases, and is greater than about 100 millidarcy; and
producing a mixture from the formation, wherein the produced mixture comprises non-condensable hydrocarbons, and wherein a molar ratio of ethene to ethane in the non-condensable hydrocarbons ranges from about 0.001 to about 0.15.

~~SUB 17~~
~~D22~~
5176. (amended) The method of claim 5175, wherein the one or more heaters comprise at least two heaters, and wherein superposition of heat from at least the two heaters pyrolyzes at least some hydrocarbons within the part of the formation.

~~SUB 17~~
~~D23~~
5177. (amended) The method of claim 5175, further comprising maintaining a temperature within the part of the formation within a pyrolysis temperature range.

Sub 110
5178. (amended) The method of claim 5175, further comprising controlling a pressure and a temperature within at least a majority of the part of the formation, wherein the pressure is controlled as a function of temperature, or the temperature is controlled as a function of pressure.

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5179. (amended) The method of claim 5175, further comprising controlling the heat such that an average heating rate of the part of the formation is less than about 1 °C per day during pyrolysis.

Sub 267
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5181. (amended) The method of claim 5175, wherein providing heat from one or more of the heaters comprises heating the part of the formation such that a thermal conductivity of at least a portion of the part of the formation is greater than about 0.5 W/(m °C).

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5193. (amended) The method of claim 5175, further comprising controlling a pressure within at least a majority of the part of the formation, wherein the controlled pressure is at least about 2.0 bar absolute.

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5196. (amended) The method of claim 5175, wherein allowing the heat to transfer comprises increasing a permeability of a majority of the part of the formation such that the permeability of the majority of the part is substantially uniform.

Sub 107
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5198. (amended) The method of claim 5175, further comprising producing a mixture in a production well, wherein at least about 7 heaters are disposed in the formation for each production well.

Sub 130
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5199. (new) The method of claim 2229, wherein at least about 20 heaters are disposed in the formation for each production well.

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5200. (new) The method of claim 2267, wherein at least about 20 heaters are disposed in the formation for each production well.

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SUB 17 5201. (new) The method of claim 2193, wherein the part of the formation comprises a selected section.

5202. (new) The method of claim 2193, wherein the part of the formation comprises a pyrolysis zone.

5203. (new) The method of claim 2193, wherein the part of the formation comprises a pyrolysis zone proximate to and/or surrounding at least one of the heaters.

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SUB 17 5204. (new) The method of claim 2193, wherein at least one of the heaters is disposed in an open wellbore.

D25 5205. (new) The method of claim 2232, wherein the part of the formation comprises a selected section.

5206. (new) The method of claim 2232, wherein the part of the formation comprises a pyrolysis zone.

5207. (new) The method of claim 2232, wherein the part of the formation comprises a pyrolysis zone proximate to and/or surrounding at least one of the heaters.

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SUB 17 5208. (new) The method of claim 2232, wherein at least one of the heaters is disposed in an open wellbore.

140 5209. (new) The method of claim 5081, wherein the part of the formation comprises a selected section.

5210. (new) The method of claim 5081, wherein the part of the formation comprises a pyrolysis zone.

~~Sub 25~~ 5211. (new) The method of claim 5081, wherein the part of the formation comprises a pyrolysis zone proximate to and/or surrounding at least one of the heaters.

~~Sub 26~~ 5212. (new) The method of claim 5081, wherein at least one of the heaters is disposed in an open wellbore.

~~Sub 27~~ 5213. (new) The method of claim 5174, wherein at least about 20 heaters are disposed in the formation for each production well.

~~Sub 28~~ 5214. (new) The method of claim 5150, wherein the part of the formation comprises a selected section.

~~Sub 29~~ 5215. (new) The method of claim 5150, wherein the part of the formation comprises a pyrolysis zone.

5216. (new) The method of claim 5150, wherein the part of the formation comprises a pyrolysis zone proximate to and/or surrounding at least one of the heaters.

~~Sub 30~~ 5217. (new) The method of claim 5150, wherein at least one of the heaters is disposed in an open wellbore.

5218. (new) The method of claim 5158, wherein at least about 20 heaters are disposed in the formation for each production well.

~~Sub 31~~ 5219. (new) The method of claim 5175, wherein the part of the formation comprises a selected section.

~~Sub 32~~ 5220. (new) The method of claim 5175, wherein the part of the formation comprises a pyrolysis zone.

SHEET 27
5221. (new) The method of claim 5175, wherein the part of the formation comprises a pyrolysis zone proximate to and/or surrounding at least one of the heaters.

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Sub 153
5222. (new) The method of claim 5175, wherein at least one of the heaters is disposed in an open wellbore. **101**

Response To Office Action Mailed July 9, 2002

A. Pending Claims

Claims 2193-2269, 5081-5090, and 5150-5222 are currently pending. Claims 2193-2202, 2204, 2219, 2224, 2226, 2227, 2229-2241, 2243, 2258, 2263, 2265, 2267-2269, 5081-5087, 5090, 5150-5154, 5156, 5169, 5172, 5174-5179, 5181, 5193, 5196, and 5198 have been amended. Claims 5199-5222 are new.

B. Submission of Corrected Formal Drawings

In the Office Action mailed July 9, 2002, the Examiner indicated approval of the proposed drawing corrections filed on March 8, 2002 [mailed on January 18, 2002]. Applicant herewith submits the corrected formal drawings approved by the Examiner (six sheets, including FIGS. 32, 44, 54, 55, 59, 60, and 63).

C. The Claims Are Not Indefinite Pursuant To 35 U.S.C. § 112, Second Paragraph

Claims 2208-2211, 2247-2250, 5159-5162, and 5183-5186 were rejected under 35 U.S.C. § 112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which applicant regards as the invention. Applicant respectfully disagrees with these rejections.

The Examiner states "Claims 2208-2211, 2247-2250, 5159-5162, and 5183-5186 are

indefinite because, insofar as a “hydrocarbon”, by definition, comprises organic compounds consisting only of carbon and hydrogen, the recited “condensable hydrocarbons” cannot include nitrogen, oxygen, sulfur and/or oxygen-containing compounds.” Applicant respectfully disagrees.

Applicant respectfully submits that Applicant has used an accepted meaning of the term “hydrocarbon” as defined by one of ordinary skill in the art. Support for this definition can be found in references within and associated with the art of the petroleum industry. For example, a reference within the art gives the following definition: “**Hydrocarbons:** molecules formed primarily by carbon and hydrogen atoms” (Hyne, N. J. *Geology for Petroleum Exploration, Drilling, and Production*, 1984, McGraw-Hill Book Company, pg. 264). The Specification (page 38, paragraph beginning on line 14) has been amended for clarification. Applicant therefore respectfully requests removal of the rejection of Applicant’s definition of the term “hydrocarbon”.

Applicant requests removal of the rejections of claims 2208-2211, 2247-2250, 5159-5162, and 5183-5186.

D. Provisional Double Patenting Rejection

The Examiner provisionally rejected claims 2193-2269, 5081-5090, and 5150-5198 under the judicially created doctrine of obviousness-type double patenting as being unpatentable over copending U.S. Patent Applications:

09/841,936; 09/841,937; 09/841,000; 09/841,060; 09/841,061; 09/841,127; 09/841,128;
09/841,129; 09/841,130; 09/841,131; 09/841,170; 09/841,193; 09/841,194; 09/841,195;
09/841,238; 09/841,239; 09/841,240; 09/841,283; 09/841,284; 09/841,285; 09/841,286;
09/841,287; 09/841,288; 09/841,289; 09/841,290; 09/841,291; 09/841,292; 09/841,293;
09/841,294; 09/841,295; 09/841,296; 09/841,297; 09/841,298; 09/841,299; 09/841,300;
09/841,301; 09/841,302; 09/841,303; 09/841,304; 09/841,305; 09/841,306; 09/841,307;
09/841,308; 09/841,309; 09/841,310; 09/841,311; 09/841,312; 09/841,429; 09/841,430;
09/841,431; 09/841,432; 09/841,433; 09/841,434; 09/841,435; 09/841,436; 09/841,437;

09/841,438; 09/841,439; 09/841,440; 09/841,441; 09/841,442; 09/841,443; 09/841,444;
09/841,445; 09/841,446; 09/841,447; 09/841,448; 09/841,449; 09/841,488; 09/841,489;
09/841,490; 09/841,491; 09/841,492; 09/841,493; 09/841,494; 09/841,495; 09/841,496;
09/841,497; 09/841,498; 09/841,499; 09/841,500; 09/841,501; 09/841,502; 09/841,632;
09/841,633; 09/841,634; 09/841,635; 09/841,636; 09/841,637; 09/841,638; and 09/841,639.

Applicant respectfully traverses the provisional double patenting rejection. Applicant respectfully submits that the omnibus nature of this rejection does not provide Applicant with sufficient detail in which to address such rejection. Applicant also respectfully submits that the rejection is also inconsistent with certain restrictions issued in the above-referenced cases. Applicant respectfully requests reconsideration.

Pursuant to the discussion in an Examiner interview on August 19, 2002, for the convenience of the Examiner, Applicant will forward copies of allowed claims for the above-referenced cases to the Examiner. Applicant understands that the Examiner will review the allowed claims for the above-referenced cases and then reconsider the double patenting rejection in view of such allowed claims.

E. The Claims Are Neither Anticipated By, Nor Obvious Over Camacho Pursuant To 35 U.S.C. § 102(b) or 103(a) Respectively

The Examiner rejected claims 2193, 2195, 2205-2218, 2226, 2227, 2230-2232, 2234, 2244-2257, 2268, 2269, 5081, 5083, 5085, 5087-5090, 5175, 5177, 5182-5192, and 5196 under 35 U.S.C. 102(b) as anticipated by or, in the alternative, under 35 U.S.C. 103(a) as obvious over U.S. Patent No. 4,067,390 to Camacho et al. (hereinafter "Camacho"). Applicant respectfully disagrees with these rejections.

The standard for "anticipation" is one of fairly strict identity. To anticipate a claim of a patent, a single prior source must contain all the claimed essential elements. *Hybritech, Inc. v. Monoclonal Antibodies, Inc.*, 802 F.2d 1367, 231 U.S.P.Q.81, 91 (Fed. Cir. 1986); *In re Donahue*, 766 F.2d 531, 226 U.S.P.Q. 619, 621 (Fed. Cir. 1985).

In order to reject a claim as obvious, the Examiner has the burden of establishing a *prima facie* case of obviousness. *In re Warner et al.*, 379 F.2d 1011, 154 U.S.P.Q. 173, 177-178 (C.C.P.A. 1967). To establish a *prima facie* obviousness of a claimed invention, all the claim limitations must be taught or suggested by the prior art. *In re Royka*, 490 F.2d 981, 180 U.S.P.Q. 580 (C.C.P.A. 1974), MPEP § 2143.03.

The Examiner states “Such permeability increase is deemed to necessarily or inherently encompass an increase to “greater than about 100 millidarcy” or “greater than about 5 Darcy”, as called for in claims 2193, 2226, 5175; alternatively, to increase the permeability to greater than 100 millidarcy or 5 Darcy would have been an obvious matter of choice in order to ensure adequate fluid flow through the formation.” Applicant respectfully disagrees.

Amended claim 2193 describes a combination of features including: “allowing the heat to transfer from one or more heaters to a part of the formation such that a permeability of at least a portion of the part of the formation increases to greater than about 100 millidarcy.” Amended claim 5175 describes a combination of features including: “allowing the heat to transfer from one or more heaters to a part of the formation such that a permeability of at least a portion of the part of the formation increases, and is greater than about 100 millidarcy.” Applicant submits that the amendments to claims 2193 and 5175 do not substantively change the scope of the claims. Support for amendments to the claim is found at least in the Specification at page 31, lines 14-19 and at page 46, lines 3-6.

Applicant submits that at least the feature of allowing heat to transfer to a part of the formation to increase a permeability to great than about 100 millidarcy, in combination with the other features of claims 2193 and 5175, does not appear to be taught or suggested by the cited art. Claim 5175 additionally describes the feature of: “producing a mixture from the formation, wherein the produced mixture comprises non-condensable hydrocarbons, and wherein a molar ratio of ethene to ethane in the non-condensable hydrocarbons ranges from about 0.001 to about 0.15.” Applicant submits that at least the above quoted feature, in combination with the other

features of claim 5175, does not appear to be taught or suggested by the cited art. Applicant respectfully submits that the Examiner's rejection of the features of claims 2193 and 5175 as obvious matters of choice or design may rely upon personal knowledge of the Examiner and therefore Applicant believes MPEP 2144.03 will apply. Pursuant to MPEP 2144.03, Applicant respectfully requests the Examiner to provide support for his assertion either by an affidavit or by references brought to the Applicant's attention. Otherwise, Applicants request this rejection be removed. *See, e.g.*, MPEP 2143.01. Applicant submits that Camacho does not appear to teach or suggest all of the features in claims 2193 and 5175 and the claims dependent thereon.

The Examiner states "It is further deemed that such permeability increase will inherently or obviously be substantially uniform, as called for in claims 2232, 2227, 5196 as illustrated in Figures 4 and 5." Applicant respectfully disagrees.

Amended claim 2232 describes a combination of features including: "allowing the heat to transfer from one or more heaters to a part of the formation to increase a permeability of a majority of at least a portion of the part of the formation such that the permeability of the majority of the part is substantially uniform." Applicant submits that the amendment to claim 2232 does not substantively change the scope of the claim. Support for amendments to the claim is found at least in the Specification at page 31, lines 14-19 and at page 46, lines 3-6. Applicant submits that the combination of features in claim 2232 does not appear to be taught or suggested by the cited art.

Camacho discloses: "The heat from torch 25 first causes the volatiles to be stripped from the surrounding coal. This devolatilization results in a cracking or fracturing of the coal, thereby increasing its porosity. The devolatilization and fracturing expands radially outwardly as a heat front advances from shaft 20." (Camacho, column 7, lines 59-64). Camacho further discloses: "The diameter of the spherical voids 20" remaining after gasification will vary with the composition of the coal and with the amount of heat supplied; the distance maintained between adjacent shafts during drilling should be determined accordingly to provide sufficient support." (Camacho, column 9, lines 31-36).

Thus, Camacho does not appear to teach or suggest at least the feature of allowing the heat to transfer from one or more heaters to a part of the formation to increase a permeability of a majority of at least a portion of the part of the formation such that the permeability of the majority of the part is substantially uniform, in combination with the other features of the claim. Applicant submits that Camacho does not appear to teach or suggest all of the features in claim 2232 and the claims dependent thereon.

Claims 2227 and 5196 describe a combination of features including: “wherein allowing the heat to transfer comprises increasing a permeability of a majority of the part of the formation such that the permeability of the part is substantially uniform.” Applicant submits that Camacho does not appear to teach or suggest all of the features in claims 2227 and 5196.

The Examiner states “Such heating effect on the coal formation is deemed to necessarily or obviously increase the permeability, as called for in claims 2193, 2232, 5081 and 5175.” Applicant respectfully disagrees.

The preamble is not given the effect of a limitation unless it breathes life and meaning into the claim. In order to limit the claim, the preamble must be “essential to point out the invention defined by the claim.” *Kropa v. Robie*, 88 USPQ 478, 481 (CCPA 1951). In claims directed to articles and apparatus, any phraseology in the preamble that limits the structure of that article or apparatus must be given weight. *In re Stencel*, 4 USPQ2d 1071 (Fed. Cir. 1987).

Claim 5081 describes a combination of features including: “providing heat from one or more heaters to the formation; allowing the heat to transfer from one or more heaters to a part of the formation such that heat from the heaters pyrolyzes at least some hydrocarbons within the part of the formation, and wherein heat from the heaters increases the permeability of at least a portion of the part of the formation; and producing a mixture comprising hydrocarbons from the formation.” The “formation” is defined in the preamble as a coal formation having an average permeability of less than about 10 millidarcy. Applicant submits that the combination of features

in claim 5081 does not appear to be taught or suggested by the cited art. Applicant respectfully submits that the Examiner's rejection of the features of claim 5081 as obvious matters of choice or design may rely upon personal knowledge of the Examiner and therefore Applicant believes MPEP 2144.03 will apply. Pursuant to MPEP 2144.03, Applicant respectfully requests the Examiner to provide support for his assertion either by an affidavit or by references brought to the Applicant's attention. Otherwise, Applicants request this rejection be removed. *See, e.g.,* MPEP 2143.01. Applicant submits Camacho does not appear to teach all of the features in claim 5081 and the claims dependent thereon.

If an independent claim is nonobvious under 35 U.S.C. 103, then any claim depending therefrom is nonobvious. *In re Fine*, 837 F.2d 1071, 5 USPQ2d 1596 (Fed. Cir. 1988). Applicant submits, however, that many of the claims dependent on claims 2193, 2232, 5081, and 5175 are separately patentable.

For example, claim 2226 describes a combination of features including: "further comprising increasing a permeability of a majority of the part of the formation to greater than about 5 Darcy." Applicant submits that the combination of features in claim 2226 does not appear to be taught or suggested by the cited art. Applicant respectfully submits that the Examiner's rejection of the features of claim 2226, in combination with the features of independent claim 2193, as obvious matters of choice or design may rely upon personal knowledge of the Examiner and therefore Applicant believes MPEP 2144.03 will apply. Pursuant to MPEP 2144.03, Applicant respectfully requests the Examiner to provide support for his assertion either by an affidavit or by references brought to the Applicant's attention. Otherwise, Applicants request this rejection be removed. *See, e.g.,* MPEP 2143.01.

Claim 5083 describes a combination of features including: "further comprising allowing heat to transfer from at least one of one or more of the heaters to the part of the formation to create thermal fractures in the formation wherein the thermal fractures substantially increase the permeability of the part of the formation." Applicant submits that at least the above quoted feature of claim 5083, in combination with the other features of the claim, does not appear to be

taught or suggested by the cited art.

Claim 5085 describes a combination of features including: “wherein at least one of the heaters comprises an electrical heater located in the formation.” Applicant submits that at least the above quoted feature of claim 5085, in combination with the other features of the claim, does not appear to be taught or suggested by the cited art.

Claim 5088 describes a combination of features including: “monitoring a composition of the produced mixture; and controlling a pressure in at least a portion of the formation to control the composition of the produced mixture.” Applicant submits that at least the above quoted feature of claim 5088, in combination with the other features of the claim, does not appear to be taught or suggested by the cited art.

Claim 5089 describes a combination of features including: “wherein the pressure is controlled by a valve proximate to a location where the mixture is produced.” Applicant submits that at least the above quoted feature of claim 5089, in combination with the other features of the claim, does not appear to be taught or suggested by the cited art.

Claim 5090 describes a combination of features including: “wherein the pressure is controlled such that pressure proximate to one or more of the heaters is greater than a pressure proximate to a location where the fluid is produced.” Applicant submits that at least the above quoted feature of claim 5090, in combination with the other features of the claim, does not appear to be taught or suggested by the cited art.

Claims 2195, 2234, and 5177 describe a combination of features including: “further comprising maintaining a temperature within the part of the formation within a pyrolysis temperature range.” Camacho appears to teach quickly raising a temperature of a face of the formation to a temperature above the pyrolysis temperature range. Applicant submits that at least the above quoted features of claims 2195, 2234, and 5177, in combination with the other features of the claims, do not appear to be taught or suggested by the cited art.

In the Office Action, the Examiner stated: "Regarding claims 2205-2218, 2244-2257, 5175 and 5182-5192, it is deemed that the myriad hydrocarbon product mixtures recited in these claims would necessarily or obviously occur in carrying out the heating process of Camacho et al, i.e., the precise composition of the product fluids is seen as dictated by the type of coal naturally occurring in the particular coal formation actually encountered in the field."

Applicant submits that the product mixtures recited in claims 2205-2218, 2244-2257, 5175, and 5182-5192 would not be producible by carrying out the heating process of Camacho. The process conditions dictated in Camacho would not appear to teach or suggest the ability to produce product mixtures as claimed in claims 2205-2218, 2244-2257, 5175, and 5182-5192. The Examiner appears to be unjustifiably extending the teaching of Camacho. Applicant requests the removal of the rejections of claims 2205-2218, 2244-2257, 5175, and 5182-5192.

F. The Claims Are Not Obvious Over Camacho Pursuant To 35 U.S.C. 103(a)

The Examiner rejected claims 2201-2204, 2219-2222, 2228-2231, 2240-2243, 2258-2261, 2266-2269, 5150, 5152, 5154-5170, 5172-5174, 5179-5181, 5193-5195, 5197, and 5198 under 35 U.S.C. 103(a) as obvious over U.S. Patent No. 4,067,390 to Camacho et al. Applicant respectfully disagrees with these rejections.

Amended claim 5150 describes a combination of features including:

allowing the heat to transfer from one or more heaters to a part of the formation such that a permeability of at least a portion of the part of the formation increases, and is greater than about 100 millidarcy; and controlling formation conditions to produce a mixture from the formation, wherein a partial pressure of H₂ within the mixture is greater than about 0.5 bars absolute.

Applicant submits that the amendment to claim 5150 does not substantively change the scope of the claim. Support for amendments to the claim is found at least in the Specification at page 31, lines 14-19 and at page 46, lines 3-6.



Applicant submits that at least allowing the heat to transfer from one or more heaters to a part of the formation such that a permeability of at least a portion of the part of the formation increases, and is greater than about 100 millidarcy; and controlling formation conditions to produce a mixture from the formation, wherein a partial pressure of H₂ within the mixture is greater than about 0.5 bars absolute, in combination with the other features of claim 5150, does not appear to be taught or suggested by the cited art. Applicant respectfully submits that the Examiner's rejection of the features of claim 5150 as obvious matters of choice or design may rely upon personal knowledge of the Examiner and therefore Applicant believes MPEP 2144.03 will apply. Pursuant to MPEP 2144.03, Applicant respectfully requests the Examiner to provide support for his assertion either by an affidavit or by references brought to the Applicant's attention. Otherwise, Applicants request this rejection be removed. *See, e.g.*, MPEP 2143.01. Applicant submits Camacho does not appear to teach all of the features in claim 5150 and the claims dependent thereon.

Applicant submits that many of the dependent claims rejected by the Examiner are independently patentable. Claim 5152 describes a combination of features including: "further comprising maintaining a temperature within the part of the formation within a pyrolysis temperature range." Applicant submits that at least the above quoted feature of claim 5152, in combination with the other features of the claim, does not appear to be taught or suggested by the cited art.

Applicant submits that the product mixtures recited in claims 5157-5168, in combination with the features of independent claim 5150, would not necessarily or obviously occur in carrying out the heating process of Camacho for at least the reasons stated herein above as outlined in Section E as regards Camacho and claims 2205-2218, 2244-2257, 5175, and 5182-5192. Applicant request these rejections be removed.

Claim 5172 recites, in part "wherein allowing the heat to transfer comprises increasing a permeability of a majority of the part of the formation such that the permeability of the majority

of the part is substantially uniform.” The combination of features of claim 5172 does not appear to be taught or suggested by the cited art for at least the reasons stated herein above as outlined in Section E as regards Camacho and claim 2232.

In the Office Action, the Examiner states: “The precise heating rate and thermal conductivity recited in claims 2201, 2202, 2240, 2241, 5154, 5179, are deemed obvious matters of choice or design based on, e.g., the quality and amount of the in place hydrocarbon present in the particular coal formation encountered in the field, consistent with objective of Camacho to provide a low rate of heating (col. 10, lines 34-40).” Applicant respectfully disagrees.

Claims 2201, 2240, 5154, and 5179 describe a combination of features including: “controlling the heat such that an average heating rate of a part of a formation is less than about 1 °C per day during pyrolysis.” Applicant submits that the combinations of features in claims 2201, 2240, 5154, and 5179 do not appear to be taught or suggested by the cited art.

Claims 2202 and 2241 describe a combination of features including: “heating a selected volume (V) of the hydrocarbon containing formation from one or more of the heaters, wherein the formation has an average heat capacity (C_v), and wherein the heating pyrolyzes at least some hydrocarbons within the selected volume of the formation; and wherein heating energy/day (Pwr) provided to the selected volume is equal to or less than $h*V*C_v*\rho_B$, wherein ρ_B is formation bulk density, and wherein an average heating rate (h) of the selected volume is about 10 °C/day.” Applicant submits the combinations of features in claims 2202 and 2241 do not appear to be taught or suggested by the cited art.

The teaching or suggestion to make the claimed combination and the reasonable expectation of success must both be found in the prior art, not in applicant’s disclosure. *In re Vaeck*, 947 F.2d 488, 20 USPQ2d 1438 (Fed. Cir. 1991), MPEP § 2143.

Applicant submits that the Examiner’s rejection of the features of claims 2201, 2202, 2240, 2241, 5154, and 5179 as obvious matters of choice or design may rely upon personal

knowledge of the Examiner and therefore Applicant believes MPEP 2144.03 will apply. Pursuant to MPEP 2144.03, Applicant respectfully requests the Examiner to provide support for his assertion either by an affidavit or by references brought to the Applicant's attention. Otherwise, Applicants request this rejection be removed. *See, e.g.*, MPEP 2143.01.

Camacho appears to teach heating the formation at a relatively high heating rate. Camacho appears to teach using a heat output of about 219,800 watts per meter to about 1,099,015 watts per meter. Applicant does not believe that the use of a heating rate that is orders of magnitude lower than the heating rate taught and suggested by the cited art would be obvious in light of the cited art. Applicant submits that the teachings and suggestions of Camacho would not allow the heating of a formation at the heating rates suggested in claims 2201, 2202, 2240, 2241, 5154, and 5179.

Claims 2203, 2242, 5155, and 5180 describe a combination of features including: "allowing the heat to transfer comprises transferring heat substantially by conduction." The combinations of features in claims 2203, 2242, 5155, and 5180 do not appear to be taught or suggested by the cited art.

In the Office Action, the Examiner states: "The thermal conductivity recited in claims 2204, 2243, 5156 is deemed an obvious matter of choice or design based on, e.g., the quality and type of the coal formation present and/or the matrix characteristics of the particular coal formation encountered in the field." Applicant respectfully disagrees.

Amended claims 2204, 2243, and 5156 describe a combination of features including: "providing heat from one or more of the heaters comprises heating the part of the formation such that a thermal conductivity of at least a portion of the part of the formation is greater than about 0.5 W/(m °C)." Applicant submits that at least this feature, in combination with the other features of the claims, does not appear to be taught or suggested by the cited art.

Applicant submits that providing heat from one or more heaters such that a thermal

conductivity of a portion of a formation is greater than about $0.5 \text{ W/(m } ^\circ\text{C)}$ is unexpected based on literature in the art. For example, Applicant's specification states:

Certain embodiments described herein will in many instances be able to economically treat formations that were previously believed to be uneconomical. Such treatment will be possible because of the surprising increases in thermal conductivity and thermal diffusivity that can be achieved with such embodiments. These surprising results are illustrated by the fact that prior literature indicated that certain coal formations exhibited relatively low values for thermal conductivity and thermal diffusivity when heated. For example, in government report No. 8364 by J. M. Singer and R. P. Tye entitled "Thermal, Mechanical, and Physical Properties of Selected Bituminous Coals and Cokes," U.S. Department of the Interior, Bureau of Mines (1979), the authors report the thermal conductivity and thermal diffusivity for four bituminous coals. This government report includes graphs of thermal conductivity and diffusivity that show relatively low values up to about $400 \text{ } ^\circ\text{C}$ (e.g., thermal conductivity is about $0.2 \text{ W/(m } ^\circ\text{C)}$ or below, and thermal diffusivity is below about $1.7 \times 10^{-3} \text{ cm}^2/\text{s}$). This government report states that "coals and cokes are excellent thermal insulators."

In contrast, in certain embodiments described herein coal may be treated such that the thermal conductivity and thermal diffusivity are significantly higher (e.g., thermal conductivity at or above about $0.5 \text{ W/(m } ^\circ\text{C)}$ and thermal diffusivity at or above $4.1 \times 10^{-3} \text{ cm}^2/\text{s}$) than would be expected based on previous literature such as government report No. 8364. If treated as described in certain embodiments herein, coal does not act as "an excellent thermal insulator." Instead, heat can and does transfer and/or diffuse into the formation at significantly higher (and better) rates than would be expected according to the literature, thereby significantly enhancing economic viability of treating the formation.

(Specification, page 136, lines 8-29).

Thus, Applicant submits that providing heat from one or more heaters heating the part of the formation such that a thermal conductivity of at least a portion of the part of the formation is greater than about $0.5 \text{ W/(m } ^\circ\text{C)}$ is not an obvious matter of choice or design. Applicant respectfully submits that the Examiner's rejection of the features of claims 2204, 2243, and 5156, in combination with the features of independent claims 2193, 2232, and 5150 respectively, as obvious matters of choice or design may rely upon personal knowledge of the Examiner and therefore Applicant believes MPEP 2144.03 will apply. Pursuant to MPEP 2144.03, Applicant respectfully requests the Examiner to provide support for his assertion either by an affidavit or by references brought to the Applicant's attention. Otherwise, Applicants request this rejection be

removed. *See, e.g.*, MPEP 2143.01.

In addition claim 5181 describes a combination of features including: “providing heat from one or more of the heaters comprises heating the part of the formation such that a thermal conductivity of at least a portion of the part of the formation is greater than about 0.5 W/(m °C).”

Applicant submits that at least the above quoted features of claim 5181, in combination with the other features of the claim, does not appear to be taught or suggested by the cited art for at least the reasons stated herein above as regards claims 2204, 2243, and 5156.

In the Office Action, the Examiner states: “The steps of 2219-2222, 2228, 2258-2261, 2266, 5169, 5170, 5173, 5193-5195, 5197 such as controlling the heat or pressure in the formation, are deemed obvious matters of choice or design in carrying out the process of Camacho et al. In this regard, Camacho et al teaches that steam injection temperature, pressure and/or volume may be controlled in response to monitoring of the fluid products. In addition, overall operating conditions within the hydrocarbon formation may be altered (noted col. 5, lines 20-27) to vary the product fluid composition(s).” Applicant respectfully disagrees.

Claims 2219, 2258, 5169, and 5193 describe a combination of features including: “controlling a pressure within at least a majority of the part of the formation, wherein the controlled pressure is at least about 2.0 bar absolute.” Camacho does not appear to teach or suggest controlling a pressure within at least a majority of the part of the formation. Camacho appears to teach injection of steam to react with a surface of the formation that is at a very high temperature. Camacho appears to teach or suggest the use of steam injection to control pressure adjacent to the formation, not within the formation. Applicant submits that at least the above quoted features in claims 2219, 2258, 5169, and 5193, in combination with the other features of the claims, does not appear to be taught or suggested by the cited art.

Claims 2220, 2259, and 5194 describe a combination of features including: “controlling formation conditions to produce a mixture from the formation, wherein a partial pressure of H₂ within the mixture is greater than about 0.5 bar.” Applicant submits that at least the above

quoted features in claims 2220, 2259, and 5194, in combination with the other features of the claims, does not appear to be taught or suggested by the cited art.

Claims 2221 and 2260 describe a combination of features including: “producing a mixture from the formation, wherein a partial pressure of H₂ within the mixture is measured when the mixture is at a production well.” Applicant submits that at least the above quoted features in claims 2221 and 2260, in combination with the other features of the claims, does not appear to be taught or suggested by the cited art.

Claims 2222, 2261, 5170, and 5195 describe a combination of features including: “altering a pressure within the formation to inhibit production of hydrocarbons from the formation having carbon numbers greater than about 25.” Applicant submits that at least the above quoted features in claims 2222, 2261, 5170, and 5195, in combination with the other features of the claims, does not appear to be taught or suggested by the cited art.

Claims 2228, 2266, 5173, and 5197 describe a combination of features including: “controlling the heat to yield greater than about 60 % by weight of condensable hydrocarbons, as measured by the Fischer Assay.” Camacho appears to teach or suggest gasification of hydrocarbons at high temperature with steam. Camacho does not appear to teach or suggest production of 60 % by weight of condensable hydrocarbons. Applicant submits that at least the above quoted features in claims 2228, 2266, 5173, and 5197, in combination with the other features of the claims, does not appear to be taught or suggested by the cited art.

Applicant submits that controlling and/or altering the pressure or heat as recited in claims 2219-2222, 2228, 2258-2261, 2266, 5169, 5170, 5173, 5193-5195, and 5197 provides unexpected and/or improved results based on the prior art. For example, Applicant’s specification states:

Controlling pressure, heat and/or heating rates of a selected section in a formation may increase production of selected formation fluids. For example, the amount and/or rate of heating may be controlled to produce formation fluids

having an American Petroleum Institute ("API") gravity greater than about 25. Heat and/or pressure may be controlled to inhibit production of olefins in the produced fluids.

Controlling formation conditions to control the pressure of hydrogen in the produced fluid may result in improved qualities of the produced fluids. In some embodiments it may be desirable to control formation conditions so that the partial pressure of hydrogen in a produced fluid is greater than about 0.5 bar absolute, as measured at a production well.

(Specification, page 13, line 28 through page 14 line 7).

Applicant's specification further discloses:

In an embodiment, a pressure within a heated portion of the formation may surprisingly increase the quality of relatively high quality pyrolyzation fluids, the quantity of relatively high quality pyrolyzation fluids, and/or vapor phase transport of the pyrolyzation fluids within the formation. Increasing the pressure often permits production of lower molecular weight hydrocarbons since such lower molecular weight hydrocarbons will more readily transport in the vapor phase in the formation. Generation of lower molecular weight hydrocarbons (and corresponding increased vapor phase transport) is believed to be due, in part, to autogenous generation and reaction of hydrogen within a portion of the coal formation. For example, maintaining an increased pressure may force hydrogen generated in the heated portion into a liquid phase (e.g. by dissolving). In addition, heating the portion to a temperature within a pyrolysis temperature range may pyrolyze at least some of the hydrocarbons within the formation to generate pyrolyzation fluids in the liquid phase. The generated components may include a double bond and/or a radical. H_2 in the liquid phase may reduce the double bond of the generated pyrolyzation fluids, thereby reducing a potential for polymerization of the generated pyrolyzation fluids. In addition, hydrogen may also neutralize radicals in the generated pyrolyzation fluids. Therefore, H_2 in the liquid phase may substantially inhibit the generated pyrolyzation fluids from reacting with each other and/or with other compounds in the formation. In this manner, shorter chain hydrocarbons may enter the vapor phase and may be produced from the formation.

Increasing the formation pressure to increase the amount of pyrolyzation fluids in the vapor phase may significantly reduce the potential for coking within the selected section of the formation. A coking reaction may occur in the liquid phase. Since many of the generated components may be transformed into short chain hydrocarbons and may enter the vapor phase, coking within the selected section may decrease.

Increasing the formation pressure to increase the amount of pyrolyzation fluids in the vapor phase is also beneficial because doing so permits increased recovery of lighter (and relatively high quality) pyrolyzation fluids. In general, pyrolyzation fluids are more quickly produced, with less residuals, when such

fluids are in the vapor phase rather than in the liquid phase. Undesirable polymerization reactions also tend to occur more frequently when the pyrolyzation fluids are in the liquid phase instead of the vapor phase. In addition, when pyrolyzation fluids are produced in the vapor phase, fewer production wells/area are needed, thereby reducing project costs.

(Specification, page 119, line 18 to page 120, line 20).

Thus, Applicant submits that steps such as controlling and/or altering the pressure or heat as recited in claims 2219-2222, 2228, 2258-2261, 2266, 5169, 5170, 5173, 5193-5195, and 5197 are not obvious matters of choice or design. Applicant respectfully submits that the Examiner's rejection of the features of claims 2219-2222, 2228, 2258-2261, 2266, 5169, 5170, 5173, 5193-5195, and 5197, in combination with the features of independent claims 2193, 2232, 5150, and 5175 respectively, as obvious matters of choice or design may rely upon personal knowledge of the Examiner and therefore Applicant believes MPEP 2144.03 will apply. Pursuant to MPEP 2144.03, Applicant respectfully requests the Examiner to provide support for his assertion either by an affidavit or by references brought to the Applicant's attention. Otherwise, Applicants request this rejection be removed. *See, e.g.*, MPEP 2143.01.

In the Office Action, the Examiner states: "Regarding claims 2229-2231, 2267-2269, 5174, 5198, Camacho et al in the embodiment of Figure 10 discloses that myriad heating wells (65) surround a production well or shaft (74). The precise number of such heating wells provided, as called for in these claims, is deemed an obvious matter of choice or design in carrying out the process of Camacho et al based on, e.g., the overall areal extent of the coal formation(s) encountered in exploiting an actual reservoir encountered in the field." Applicant respectfully disagrees.

Claims 2229, 2267, 5174, and 5198 describe a combination of features including: "producing a mixture in a production well, and wherein at least about 7 heaters are disposed in the formation for each production well." Each well of Camacho appears to be a production well. Applicant submits that at least the above quoted features of claims 2229, 2267, 5174, and 5198, in combination with the other features of the claims, do not appear to be taught or suggested by the cited art.

Claims 2230 and 2268 describe a combination of features including: “further comprising providing heat from three or more heaters to at least a portion of the formation, wherein three or more of the heaters are located in the formation in a unit of heaters, and wherein the unit of heaters comprises a triangular pattern.” Applicant submits that at least the above quoted features of claims 2230 and 2268, in combination with the other features of the claims, do not appear to be taught or suggested by the cited art.

Claims 2231 and 2269 describe a combination of features including: “providing heat from three or more heaters to at least a portion of the formation, wherein three or more of the heaters are located in the formation in a unit of heaters, wherein the unit of heaters comprises a triangular pattern, and wherein a plurality of the units are repeated over an area of the formation to form a repetitive pattern of units.” Applicant submits that at least the above quoted features of claims 2231 and 2269, in combination with the other features of the claims, do not appear to be taught or suggested by the cited art.

Applicant requests removal of the obviousness rejection of claims 2201-2204, 2219-2222, 2228-2231, 2240-2243, 2258-2261, 2266-2269, 5150, 5152, 5154-5170, 5172-5174, 5179-5181, 5193-5195, 5197, and 5198.

G. The Claims Are Not Obvious Over Camacho In View of Hoekstra or Garrett Pursuant To 35 U.S.C. 103(a)

The Examiner rejected claims 2225 and 2264 as being unpatentable under 35 U.S.C. § 103(a) over Camacho as applied to claim 2232, and further in view of U.S. Patent No. 4,353,418 to Hoekstra et al. (hereinafter “Hoekstra”) or U.S. Patent No. 3,661,423 to Garrett (hereinafter “Garrett”). Applicant respectfully disagrees.

Claims 2225 describes a combination of features including: “allowing the heat to transfer from one or more heaters to a part of the formation such that a permeability of at least a portion

of the part of the formation increases to greater than about 100 millidarcy.” The combination of Camacho or Justheim with Hoekstra or Garrett does not appear to teach or suggest at least the quoted feature, in combination with the other features of claim 2225. Claim 2264 describes a combination of features including: “allowing the heat to transfer from one or more heaters to a part of the formation to increase a permeability of a majority of at least a portion of the part of the formation such that the permeability of the majority of the part is substantially uniform.” The combination of Camacho or Justheim with Hoekstra or Garrett do not appear to teach or suggest at least the quoted feature, in combination with the other features of claim 2264.

H. The Claims Are Neither Anticipated By, Nor Obvious Over Justheim Pursuant To 35 U.S.C. § 102(b) or 103(a) Respectively

The Examiner rejected claims 2193, 2195, 2199, 2205-2218, 2226, 2227, 2232, 2234, 2244-2257, 5081, 5083, 5088, 5090, 5175, 5177, 5182-5192, and 5196 under 35 U.S.C. 102(b) as anticipated by or, in the alternative, under 35 U.S.C. 103(a) as obvious over U.S. Patent No. 3,766,982 to Justheim (hereinafter “Justheim”). Applicant respectfully disagrees with these rejections.

Claims 2193, 2232, 5081, and 5175 describe combinations of features, each including the feature of “providing heat from one or more heaters to a portion of the formation; ...” Justheim does not appear to teach or suggest at least this feature of each of claims 2193, 2232, 5081, and 5175, in combination with the other individual features of each of the claims.

The Examiner states “It is further deemed that such permeability increase will inherently or obviously be substantially “uniform”, as called for in claims 2232, 2227, and 5196, e.g. since the injected heated air which causes the permeability increase permeates throughout the hydrocarbonaceous formation.” Applicant respectfully disagrees that the permeability will inherently or obviously increase. Justheim teaches injecting heated air into a formation. Injection of a heated fluid may preferentially flow through channels or fractures in the formation. Such preferential flow would inhibit the formation of uniform permeability and/or a

permeability greater than 100 millidarcy.

In addition, claim 5175 describe a combination of features including: “producing a mixture from the formation, wherein the produced mixture comprises non-condensable hydrocarbons, and wherein a molar ratio of ethene to ethane in the non-condensable hydrocarbons ranges from about 0.001 to about 0.15.” Applicant submits that at least the above quoted feature, in combination with the other features of claim 5175, does not appear to be taught or suggested by the cited art.

Claim 5081 describes a combination of features including: “providing heat from one or more heaters to the formation; allowing the heat to transfer from one or more heaters to a part of the formation such that heat from the heaters pyrolyzes at least some hydrocarbons within the part of the formation, and wherein heat from the heaters increases the permeability of at least a portion of the part of the formation; and producing a mixture comprising hydrocarbons from the formation.” The “formation” is defined in the preamble as a coal formation having an average permeability of less than about 10 millidarcy. Applicant submits that the combination of features in claim 5081 does not appear to be taught or suggested by the cited art.

Applicant believes that many of the dependent claims of independent claims are independently patentably over the cited art. For example, claim 2226 describes a combination of features including: “further comprising increasing a permeability of a majority of the part of the formation to greater than about 5 Darcy.” At least this feature of claim 2226, in combination with the other features of the claim, does not appear to be taught, suggested or an obvious design choice in light of Justheim. Claims 2227 and 5196 recite, in part “wherein allowing the heat to transfer comprises substantially uniformly increasing a permeability of a majority of the part of the formation.” At least this feature, in combination with the other features of claims 2227 and 5196, do not appear to be taught or suggested by the cited art.

Claim 5083 describes a combination of features including: “further comprising allowing heat to transfer from at least one of one or more of the heaters to the part of the formation to

create thermal fractures in the formation wherein the thermal fractures substantially increase the permeability of the part of the formation.” At least this feature, in combination with the other features of claim 5083, does not appear to be taught or suggested by the cited art.

Claim 5088 describes a combination of features including: “monitoring a composition of the produced mixture; and controlling a pressure in at least a portion of the formation to control the composition of the produced mixture.” At least this feature, in combination with the other features of claim 5088, does not appear to be taught or suggested by the cited art.

Claim 5090 describes a combination of features including: “wherein the pressure is controlled such that pressure proximate to one or more of the heaters is greater than a pressure proximate to a location where the fluid is produced.” At least this feature, in combination with the other features of claim 5090, does not appear to be taught or suggested by the cited art.

Claims 2195, 2234, and 5177 describe a combination of features including: “maintaining a temperature within the part of the formation within a pyrolysis temperature range.” At least this feature, in combination with the other features of claims 2195, 2234, and 5177, do not appear to be taught or suggested by the cited art.

Claim 2199 recites, in part “wherein one or more of the heaters comprise natural distributed combustors.” At least this feature, in combination with the other features of claim 2199, does not appear to be taught or suggested by the cited art.

In the Office Action, the Examiner stated: “Regarding claims 2205-2218, 2244-2257, 5175 and 5182-5192, it is deemed that the myriad hydrocarbon product mixtures recited in these claims would necessarily or obviously occur in carrying out the heating process of Justheim, i.e., the precise composition of the product fluids is seen as dictated by the type of coal naturally occurring in the particular coal formation actually encountered in the field.” Applicant respectfully disagrees.

Applicant submits that the product mixtures recited in claims 2205-2218, 2244-2257, 5175, and 5182-5192 would not be producible by carrying out the heating process of Justheim. The product mixtures recited in claims 2205-2218, 2244-2257, 5175, and 5182-5192 may be produced by controlling and/or modifying formation conditions during treatment to produce the selected results recited in the claims. Applicant submits that the product mixtures recited in claims 2205-2218, 2244-2257, 5175, and 5182-5192 would not necessarily or obviously occur in carrying out the heating process of Justheim for at least the reasons stated herein above as outlined in Section E as regards Camacho.

I. The Claims Are Not Obvious Over Justheim Pursuant To 35 U.S.C. § 103(a)

The Examiner rejected claims 2201-2204, 2219-2224, 2228, 2240-2243, 2258-2263, 2266, 5150, 5152, 5154-5173, 5179-5181, 5193-5195, and 5197 under 35 U.S.C. 103(a) as obvious over U.S. Patent No. 3,766,982 to Justheim. Applicant respectfully disagrees with these rejections.

Claim 5150 describes a combination of features including: “allowing the heat to transfer from one or more heaters to a part of the formation such that a permeability of at least a portion of the part of the formation increases, and is greater than about 100 millidarcy.” Applicant submits that at least allowing heat to transfer to a part of the formation to increase a permeability to great than about 100 millidarcy, in combination with the other features of claim 5150, does not appear to be taught or suggested by the cited art. Applicant respectfully submits that the Examiner’s rejection of the features of claim 5150 as obvious matters of choice or design may rely upon personal knowledge of the Examiner and therefore Applicant believes MPEP 2144.03 will apply. Pursuant to MPEP 2144.03, Applicant respectfully requests the Examiner to provide support for his assertion either by an affidavit or by references brought to the Applicant’s attention. Otherwise, Applicants request this rejection be removed. *See, e.g.,* MPEP 2143.01.

In addition, claim 5150 describe a combination of features including: “controlling formation conditions to produce a mixture from the formation, wherein a partial pressure of H₂

within the mixture is greater than about 0.5 bars absolute.” Applicant submits that at least the above quoted feature, in combination with the other features of claim 5150, does not appear to be taught or suggested by the cited art. Applicant respectfully submits that the Examiner’s rejection of the features of claim 5150 as obvious matters of choice or design may rely upon personal knowledge of the Examiner and therefore Applicant believes MPEP 2144.03 will apply. Pursuant to MPEP 2144.03, Applicant respectfully requests the Examiner to provide support for his assertion either by an affidavit or by references brought to the Applicant’s attention. Otherwise, Applicants request this rejection be removed. *See, e.g.*, MPEP 2143.01. Applicant submits Justheim does not appear to teach all of the features in claim 5150 and the claims dependent thereon.

Applicant submits that many of the dependent claims rejected by the Examiner are independently patentable. Claim 5152 describes a combination of features including: “further comprising maintaining a temperature within the part of the formation within a pyrolysis temperature range.” At least this feature, in combination with the other features of claim 5152, does not appear to be taught or suggested by the cited art.

Applicant submits that the product mixtures recited in claims 5157-5168 would not be producible by carrying out the heating process of Justheim. The product mixtures recited in claims 5157-5168 may be produced by controlling and/or modifying formation conditions during treatment to produce the selected results recited in the claims. Applicant submits that the product mixtures recited in claims 5157-5168, in combination with the features of independent claim 5150, would not necessarily or obviously occur in carrying out the heating process of Justheim for at least the reasons stated herein above as outlined in Section E as regards Camacho and claims 2205-2218, 2244-2257, 5175, and 5182-5192. Applicant request these rejections be removed.

Claim 5172 recites, in part “wherein allowing the heat to transfer comprises increasing a permeability of a majority of the part of the formation such that the permeability of the majority of the part is substantially uniform.” At least this feature, in combination with the other features

of claim 5172, does not appear to be taught or suggested by the cited art.

In the Office Action, the Examiner states: "The precise heating rate and thermal conductivity recited in claims 2201, 2202, 2240, 2241, 5154, 5179, are deemed obvious matters of choice or design based on, e.g., the quality and amount of the in place hydrocarbon present in the particular coal formation encountered in the field in carrying out the process of Justheim." Applicant respectfully disagrees.

Claims 2201, 2240, 5154, and 5179 describe a combination of features including: "controlling the heat such that an average heating rate of a part of a formation is less than about 1 °C per day during pyrolysis." Applicant submits that at least the quoted features of claims 2201, 2240, 5154, and 5179, in combination with the other features the claims, do not appear to be taught or suggested by the cited art.

Claims 2202 and 2241 describes a combination of features including: "heating a selected volume (V) of the hydrocarbon containing formation from one or more of the heaters, wherein the formation has an average heat capacity (C_v), and wherein the heating pyrolyzes at least some hydrocarbons within the selected volume of the formation; and wherein heating energy/day (Pwr) provided to the selected volume is equal to or less than $h \cdot V \cdot C_v \cdot \rho_B$, wherein ρ_B is formation bulk density, and wherein an average heating rate (h) of the selected volume is about 10 °C/day." Applicant submits that at least the quoted features of claims 2202 and 2241, in combination with the other features the claims, do not appear to be taught or suggested by the cited art.

Claims 2203, 2242, 5155, and 5180 describe a combination of features including: "allowing the heat to transfer comprises transferring heat substantially by conduction." Applicant submits that at least the quoted features of claims 2203, 2242, 5155, and 5180, in combination with the other features the claims, do not appear to be taught or suggested by the cited art.

In the Office Action, the Examiner states: "The thermal conductivity recited in claim

2204, 2243, 5156, 5181 is deemed an obvious matter of choice or design based on, e.g., the quality and type of the coal formation present and/or the matrix of characteristics of the particular coal formation encountered in the field.” Applicant respectfully disagrees.

Amended claims 2204, 2243, 5156, and 5181 describe a combination of features including: “providing heat from one or more of the heaters comprises heating the part of the formation such that a thermal conductivity of at least a portion of the part of the formation is greater than about 0.5 W/(m °C).” Applicant submits that providing heat from one or more heaters such that a thermal conductivity of a portion of a formation is greater than about 0.5 W/(m °C) is unexpected based on literature in the art as outlined above in Section F as regards Camacho. Applicant submits that at least the quoted feature of claims 2204, 2243, 5156, and 5181, in combination with the other features of the claims, do not appear to be taught, suggested, inherent or obvious design choice in light of the cited art.

In the Office Action, the Examiner states: “The steps of 2219, 2222, 2228, 2258, 2261, 2266, 5169, 5170, 5173, 5193, 5195, 5197 such as controlling the heat or pressure in the formation, are deemed obvious matters of choice or design in carrying out the process of Justheim.” Applicant submits that controlling and/or altering the pressure or heat as recited in claims 2219, 2222, 2228, 2258, 2261, 2266, 5169, 5170, 5173, 5193, 5195, 5197 provides unexpected and/or improved results based on the prior art as outlined in Section F as regards Camacho and claims 2219, 2222, 2228, 2258, 2261, 2266, 5169, 5170, 5173, 5193, 5195, 5197. Applicant submits that controlling and/or altering the pressure or heat as recited in claims 2219, 2222, 2228, 2258, 2261, 2266, 5169, 5170, 5173, 5193, 5195, 5197 are not obvious matters of choice or design.

Applicant requests removal of the obviousness rejection of claims 2201-2204, 2219-2224, 2228, 2240-2243, 2258-2263, 2266, 5150, 5152, 5154-5173, 5179-5181, 5193-5195, and 5197.

J. The Claims Are Not Obvious Over Justheim In View of Hoekstra or Garrett Pursuant To 35 U.S.C. 103(a)

The Examiner rejected claims 2225 and 2264 as being unpatentable under 35 U.S.C. § 103(a) over U.S. Patent No. 3,766,982 to Justheim as applied to claim 2193, and further in view of U.S. Patent No. 4,353,418 to Hoekstra et al. or U.S. Patent No. 3,661,423 to Garrett. Applicant respectfully disagrees.

Claims 2225 and 2264 each describe a combination of features including: “providing heat from one or more heaters to at least a portion of the formation.” At least the above quoted feature, in combination with the other features of the claims, does not appear to be taught or suggested by the combination of Justheim with Hoekstra or Garrett. Applicant requests removal of the obviousness rejection of claims 2225 and 2264.

K. The Claims Are Not Obvious Over Justheim In View of Salomonsson or Camacho Pursuant To 35 U.S.C. 103(a)

The Examiner rejected claims 2230, 2231, 2268, and 2269 under 35 U.S.C. 103(a) as obvious over U.S. Patent No. 3,766,982 to Justheim as applied to claim 2193, and further in view of U.S. Patent No. 2,914,309 to Salomonsson (hereinafter “Salomonsson”) or U.S. Patent No. 4,067,390 to Camacho et al. Applicant respectfully disagrees with these rejections.

The rejected claims each describe a combination of features including: “providing heat from one or more heaters to at least a portion of the formation.” Justheim does not appear to teach or suggest the use of heaters. The combination of Justheim with Salomonsson or Camacho does not appear to teach or suggest all the features of the rejected claims. Applicant requests removal of the obviousness rejections of claims 2230, 2231, 2268, and 2269 in light of Justheim with Salomonsson or Camacho.

L. The Claims Are Neither Anticipated By, Nor Obvious Over Ljungstrom Pursuant To 35 U.S.C. § 102(b) or 103(a) Respectively

The Examiner rejected claims 2193-2195, 2199, 2200, 2203, 2205-2215, 2217, 2218, 2226, 2227, 2232-2234, 2238, 2239, 2242, 2244-2254, 2256, 2257, 2265, 5081-5085, 5175-5178, 5180, 5182-5190, 5192, and 5196 under 35 U.S.C. 102(b) as anticipated by or, in the alternative, under 35 U.S.C. 103(a) as obvious over U.S. Patent No. 2,923,535 to Ljungstrom (hereinafter "Ljungstrom"). Applicant respectfully disagrees with these rejections.

The Examiner states "Such permeability increase is deemed to necessarily or inherently encompass an increase to "greater than about 100 millidarcy" or "greater than about 5 Darcy", as called for in claims 2193, 2226, 2265, 5175; alternatively, to increase the permeability to greater than 100 millidarcy or 5 Darcy would have been an obvious matter of choice in order to ensure adequate fluid flow through the formation." Applicant respectfully disagrees.

Applicant disagrees that the teachings and suggestions of Ljungstrom would necessarily or inherently encompass an increase in permeability as claimed in the present application. Ljungstrom does not appear to teach or suggest allowing the heat to transfer (e.g., controlling the heat input rate) to increase the permeability of the formation as claimed. Claims 2193 describes a combination of features including: "allowing the heat to transfer from one or more heaters to a part of the formation such that a permeability of at least a portion of the part of the formation increases to greater than about 100 millidarcy." Claim 5175 describes a combination of features including: "allowing the heat to transfer from one or more of the heaters to a part of the formation such that a permeability of at least a portion of the part of the formation increases, and is greater than about 100 millidarcy." Ljungstrom does not appear to teach or suggest "allowing the heat to transfer" in a manner capable of achieving the claimed features, in combination with the other features of the claims. Allowing the heat to transfer in a manner capable of achieving the claimed features is not inherent, necessary or an obvious matter of choice based on the teachings or suggestions of Ljungstrom. Ljungstrom appears to teach or suggest heating the formation quickly substantially by the use of forced burning of a portion of the formation

(combustion) towards a production well or wells. It appears that the burning of the formation would produce coke in the formation that would inhibit a substantially uniform permeability and/or a permeability greater than about 100 millidarcy. Applicant submits that Ljungstrom does not appear to teach or suggest the combination of features in claims 2193, 5175, and the claims dependent thereon.

The Examiner states "It is further deemed that such permeability increase will inherently or obviously be substantially uniform, as called for in claims 2232, 2227, 5196, e.g. during an overall field test as illustrated in Figures 2-5." Applicant respectfully disagrees.

Claim 2232 describes a combination of features including: "allowing the heat to transfer from one or more heaters to a part of the formation to increase a permeability of a majority of at least a portion of the part of the formation such that the permeability of the majority of the part is substantially uniform." Applicant submits that the combination of features in claim 2232 does not appear to be taught or suggested by the cited art.

Ljungstrom states, "The pressure drop was different in different directions, showing a different porosity and permeability for the gas flow." (Ljungstrom, column 5, lines 58-60). Thus, Ljungstrom does not appear to teach or suggest at least the feature of "allowing the heat to transfer from one or more heaters to a part of the formation to increase a permeability of a majority of at least a portion of the part of the formation such that the permeability of the majority of the part is substantially uniform," in combination with the other features of the claims. Applicant submits that Ljungstrom does not appear to teach or suggest the combination of features in claim 2232 and the claims dependent thereon

The Examiner states:

With further regard to claim 5081, noted above, it is deemed that Ljungstrom (col. 2, lines 1-24) discloses that the coal formation may be "relatively impermeable"; thus it is deemed that such coal formation will inherently or obviously possess an initial permeability of less than 10 millidarcy, depending on

the particular formation or field encountered. Alternatively, to choose a coal deposit of such low permeability would have been an obvious matter of choice or design, especially since the process does not require the initial injection of fluid directly into or through the formation.

Applicant respectfully disagrees.

Claim 5081 describes a combination of features including: “allowing the heat to transfer from one or more heaters to a part of the formation such that heat from the heaters pyrolyzes at least some hydrocarbons within the part of the formation, and wherein heat from the heaters increases the permeability of at least a portion of the part of the formation.” Applicant submits that the combination of features in claim 5081 does not appear to be taught or suggested by the cited art. Applicant submits that Ljungstrom does not appear to teach or suggest the combination of features in claim 5081 and the claims dependent thereon.

In addition, claims 2193, 2232, and 5175 describe a combination of features including: “providing heat from one or more heaters to at least a portion of the formation; and allowing the heat to transfer from one or more heaters to a part of the formation.” Claim 5081 describes a combination of features including: “providing heat from one or more heaters to the formation; allowing the heat to transfer from one or more heaters to a part of the formation.” Applicant submits that the combination of features in claims 2193, 2232, 5081, and 5175 does not appear to be taught or suggested by the cited art. Applicant submits that Ljungstrom does not appear to teach or suggest the combination of features in claims 2193, 2232, 5081, 5175, and the claims dependent thereon.

Applicant requests removal of the anticipation and/or obviousness rejections of claims 2193-2195, 2199, 2200, 2203, 2205-2215, 2217, 2218, 2226, 2227, 2232-2234, 2238, 2239, 2242, 2244-2254, 2256, 2257, 2265, 5081-5085, 5175-5178, 5180, 5182-5190, 5192, and 5196.

M. The Claims Are Not Obvious Over Ljungstrom Pursuant To 35 U.S.C. 103(a)

The Examiner rejected claims 2201, 2202, 2204, 2219, 2222, 2228, 2229, 2240, 2241, 2243, 2258, 2261, 2266, 2267, 5179, 5181, 5193, 5195, 5197, and 5198 under 35 U.S.C. 103(a) as obvious over U.S. Patent No. 2,923,535 to Ljungstrom. Applicant respectfully disagrees with these rejections.

Claims 2201, 2240, and 5179 describe a combination of features including: “controlling the heat such that an average heating rate of a part of a formation is less than about 1 °C per day during pyrolysis.” Ljungstrom appears to teach or suggest combusting the formation towards production wells. Ljungstrom does not appear to teach or suggest at least the above quoted features of claims 2201, 2240, and 5179, in combination with the other features of the claims.

Claims 2202 and 2241 describes a combination of features including: “heating a selected volume (V) of the hydrocarbon containing formation from one or more of the heaters, wherein the formation has an average heat capacity (C_v), and wherein the heating pyrolyzes at least some hydrocarbons within the selected volume of the formation; and wherein heating energy/day (P_{wr}) provided to the selected volume is equal to or less than $h \cdot V \cdot C_v \cdot \rho_B$, wherein ρ_B is formation bulk density, and wherein an average heating rate (h) of the selected volume is about 10 °C/day.” Ljungstrom does not appear to teach or suggest at least the above quoted feature of claims 2202 and 2241, in combination with the other features of the claims.

In the Office Action, the Examiner states: “The thermal conductivity recited in claims 2204, 2243, 5181 is deemed an obvious matter of choice or design based on, e.g., the quality and type of the coal formation present and/or the matrix characteristics of the particular coal formation encountered in the field.” Applicant respectfully disagrees.

Claims 2204, 2243, and 5181 describe a combination of features including: “providing heat from one or more of the heaters comprises heating the part of the formation such that a thermal conductivity of at least a portion of the part of the formation is greater than about 0.5

W/(m °C).” Ljungstrom does not appear to teach or suggest at least the above quoted features of claims 2204, 2243, and 5181, in combination with the other features of the claims.

Applicant submits that providing heat from one or more heaters such that a thermal conductivity of a portion of a formation is greater than about 0.5 W/(m °C) is unexpected based on literature in the art as outlined in Section F as regards Camacho and claims 2204, 2243, and 5156.

In the Office Action, the Examiner states: “The steps of 2219, 2222, 2228, 2258, 2261, 2266 5193, 5195, 5197 such as controlling the heat or pressure in the formation, are deemed obvious matters of choice or design in carrying out the process of Ljungstrom, consistent with one of the overall objectives of Ljungstrom to control the heating process (col. 2, lines 25-55).” Applicant respectfully disagrees. As discussed in Section F as regards Camacho, Applicant believes that controlling the heat or pressure is not inherent, or an obvious matter of choice or design.

Claims 2219, 2258, and 5193 describe a combination of features including: “controlling a pressure within at least a majority of the part of the formation, wherein the controlled pressure is at least about 2.0 bar absolute.” Applicant submits that at least the quoted features of claims 2219, 2258, and 5193, in combination with the other features of the claims, do not appear to be taught or suggested by the cited art.

Claims 2222, 2261, and 5195 describe a combination of features including: “altering a pressure within the formation to inhibit production of hydrocarbons from the formation having carbon numbers greater than about 25.” Applicant submits that at least the quoted features of claims 2222, 2261, and 5195, in combination with the other features of the claims, do not appear to be taught or suggested by the cited art.

Claims 2228, 2266, and 5197 describe a combination of features including: “controlling the heat to yield greater than about 60 % by weight of condensable hydrocarbons, as measured by

the Fischer Assay.” Applicant submits that at least the quoted features of claims 2228, 2266, and 5197, in combination with the other features of the claims, does not appear to be taught or suggested by the cited art.

Applicant submits that steps such as controlling and/or altering the pressure or heat as recited in claims 2219, 2222, 2228, 2258, 2261, 2266 5193, 5195, and 5197 provides unexpected and/or improved results based on the prior art as outlined in Section F as regards Camacho and claims 2219-2222, 2228, 2258-2261, 2266, 5169, 5170, 5173, 5193-5195.

In the Office Action, the Examiner states:

Regarding claims 2229, 2267, 5198, Ljungstrom in the embodiment of Figures 2-5 and 9, discloses that myriad heating wellbores (20) may surround a production wellbore or shaft (26). The precise number of such heating well provided, as called for in these claims, is deemed an obvious matter of choice or design in carrying out the process of Ljungstrom based on, e.g., the overall areal extent of the coal formation(s) encountered in exploiting an actual reservoir encountered in the field.

Applicant respectfully disagrees that the number of heater wells to production wells is an obvious matter of choice or design. Ljungstrom discloses:

Electrical heating elements 22 may be arranged in holes 20 in groups comprising six elements about a common gas exhaust passage 26, as will appear from Figures 2-5.

(Ljungstrom, column 2, lines 65-68).

Ljungstrom discloses:

In the holes in the corners of the hexagons were inserted electrical heating elements. A power of 10 kilowatts was evenly distributed over the part of the element, which was placed in the oil shale.

(Ljungstrom, column 4, lines 49-53).

Ljungstrom appears to teach 6 electrical heaters disposed in a formation about a

production well in a hexagonal pattern. Ljungstrom does not appear to provide any suggestion or motivation for using 7 or more heaters per production well. In addition, Ljungstrom does not appear to teach or suggest varying the number of heaters based upon various factors described in Applicant's specification.

Applicant submits that the selection of the number of heater wells provided for a production well is not an obvious matter of choice or design but, rather, may be based upon non-obvious choices such as desired product composition, desired production rates, desired heating rates, etc. Claims 2229, 2267, and 5198 describe a combination of features including: "producing a mixture in a production well, and wherein at least about 7 heaters are disposed in the formation for each production well. At least the above quoted features of claims 2229, 2267, and 5198, in combination with the other features of each claim, do not appear to be taught, suggested, or obvious in light of the cited art.

Applicant requests removal of the obviousness rejection of claims 2201, 2202, 2204, 2219, 2222, 2228, 2229, 2240, 2241, 2243, 2258, 2261, 2266, 2267, 5179, 5181, 5193, 5195, 5197, and 5198.

N. The Claims Are Not Obvious Over Ljungstrom In View of Tsai Pursuant To 35 U.S.C. 103(a)

The Examiner rejected claims 2216, 2220, 2221, 2255, 2259, 2260, 5150-5170, 5172-5174, 5191, and 5194 as being unpatentable under 35 U.S.C. § 103(a) over U.S. Patent No. 2,923,535 to Ljungstrom as applied to claim 2193, in view of U.S. Patent No. 4,299,285 to Tsai et al. (hereinafter "Tsai"). Applicant respectfully disagrees.

The rejected claims describe combinations of features including: "allowing the heat to transfer from one or more heaters to a part of the formation such that a permeability of at least a portion of the part of the formation increases to greater than about 100 millidarcy" or "allowing the heat to transfer from one or more heaters to a part of the formation to increase a permeability

of a majority of at least a portion of the part of the formation such that the permeability of the majority of the part is substantially uniform.” Applicant does not believe that the combination of Ljungstrom and Tsai teaches or suggests at least the above quoted features of the claims, in combination with the other features of the claims. Ljungstrom and Tsai do not appear to teach or suggest allowing heat to transfer to control a permeability characteristic. The specific features of the individual claims relating to hydrogen are not matters of obvious design or choice but are part of the claim as a whole. The combination of Ljungstrom and Tsai does not appear to teach or suggest the features related to hydrogen in combination with the other features of the claims.

Applicant requests removal of the obviousness rejection of claims 2216, 2220, 2221, 2255, 2259, 2260, 5150-5170, 5172-5174, 5191, and 5194.

O. The Claims Are Not Obvious Over Ljungstrom In View of Justheim Pursuant To 35 U.S.C. 103(a)

The Examiner rejected claims 2216, 2220, 2221, 2223, 2224, 2255, 2259, 2260, 2262, 2263, 5150-5174, 5191, and 5194 as being unpatentable under 35 U.S.C. § 103(a) over U.S. Patent No. 2,923,535 to Ljungstrom as applied to claim 2193, in view of U.S. Patent No. 3,766,982 to Justheim et al. Applicant respectfully disagrees.

Applicant submits that features such as controlling and/or altering the pressure or heat as recited in claims 2216, 2220, 2221, 2223, 2224, 2255, 2259, 2260, 2262, 2263, 5150-5174, 5191, and 5194 provides unexpected and/or improved results based on the prior art as outlined in Section F as regards Camacho and claims 2219-2222, 2228, 2258-2261, 2266, 5169, 5170, 5173, 5193-5195, and 5197. Thus, Applicant submits that steps such as controlling and/or altering the pressure or heat as recited in claims 2216, 2220, 2221, 2223, 2224, 2255, 2259, 2260, 2262, 2263, 5150-5174, 5191, and 5194 are not obvious matters of choice or design. Applicant respectfully submits that the rejected claims describe combinations of features, and that the combination of features are not taught, described, or obvious matters of choice or design in light of the combination of Ljungstrom and Justheim.

Applicant requests removal of the obviousness rejection of claims 2216, 2220, 2221, 2223, 2224, 2255, 2259, 2260, 2262, 2263, 5150-5174, 5191, and 5194.

P. The Claims Are Not Obvious Over Ljungstrom In View of Justheim And Further in View of Hoekstra or Garrett Pursuant To 35 U.S.C. 103(a)

The Examiner rejected claims 2225 and 2264 as being unpatentable under 35 U.S.C. § 103(a) over U.S. Patent No. 2,923,535 to Ljungstrom in view of U.S. Patent No. 3,766,982 to Justheim et al. as applied to claim 2223, and further in view of U.S. Patent No. 4,353,418 to Hoekstra et al. or U.S. Patent No. 3,661,423 to Garrett. Applicant respectfully disagrees that the claims are obvious in light of the cited art. Applicant does not believe that the combination of features of claims 2225 and 2264 are taught or suggested by the combination of Ljungstrom in light of Justheim, or by the combination of Ljungstrom and Justheim in light of Hoekstra or Garrett. Applicant requests removal of the rejections of claims 2225 and 2264.

Q. The Claims Are Not Obvious Over Ljungstrom In View of Salomonsson or Camacho Pursuant To 35 U.S.C. 103(a)

The Examiner rejected claims 2230, 2231, 2268, 2269, and 5087 under 35 U.S.C. 103(a) as obvious over U.S. Patent No. 2,923,535 to Ljungstrom as applied to claim 2193, and further in view of U.S. Patent No. 2,914,309 to Salomonsson or U.S. Patent No. 4,067,390 to Camacho et al. Applicant respectfully disagrees with these rejections.

The rejected claims describe combinations of features including: “allowing the heat to transfer from one or more heaters to a part of the formation such that a permeability of at least a portion of the part of the formation increases to greater than about 100 millidarcy” or “allowing the heat to transfer from one or more heaters to a part of the formation to increase a permeability of a majority of at least a portion of the part of the formation such that the permeability of the majority of the part is substantially uniform.” Applicant does not believe that the combination of

Ljungstrom and Salomonsson or Camacho teaches or suggests at least the above quoted features of the claims, in combination with the other features of the claims. Ljungstrom, Salomonsson and/or Camacho do appear to teach or suggest allowing heat to transfer to control a permeability characteristic. The specific features of the individual claims relating to well placement are not matters of obvious design or choice but are part of the claim as a whole. The combination of Ljungstrom and Salomonsson or Camacho does not appear to teach or suggest the features related to well placement in combination with the other features of the claims.

Applicant requests removal of the obviousness rejection of claims 2230, 2231, 2268, 2269, and 5087.

R. The Claims Are Not Obvious Over Justheim '689 In View of Justheim '982 Pursuant To 35 U.S.C. 103(a)

The Examiner rejected claims 5081, 5084, 5086, 5087, and 5090 under 35 U.S.C. 103(a) as obvious over U.S. Patent No. 3,237,689 to Justheim (hereinafter "Justheim '689") in view of U.S. Patent No. 3,766,982 to Justheim (hereinafter "Justheim '982"). Applicant respectfully disagrees with these rejections.

The Examiner states:

With specific regard to claim 5081, it is deemed that the "rapid distillation of organic components", "progressive shrinking and fissuring of more remote areas at a rapid rate" of the coal formation effected by the process of Justheim '689, as modified, will necessarily or obviously increase the overall permeability of the coal formation. Also, it is deemed that the solid carbonaceous deposit or coal will inherently or obviously possess an initial permeability of less than 10 millidarcy, depending on the particular formation or field encountered. Alternatively, to choose a coal deposit of such low permeability would have been an obvious matter of choice or design, especially since the process does not require the injection of fluid directly into or through the formation. Thus, the skilled practitioner can recover hydrocarbons from formations not readily accessible to fluid injection.

Applicant respectfully disagrees.

Claim 5081 describes a combination of features including: “allowing the heat to transfer from one or more heaters to a part of the formation such that heat from the heaters pyrolyzes at least some hydrocarbons within the part of the formation, and wherein heat from the heaters increases the permeability of at least a portion of the part of the formation.” Applicant submits that the combination of features in claim 5081 does not appear to be taught or suggested by the cited art. Applicant respectfully submits that the Examiner’s rejection of the features of claim 5081 as obvious matters of choice or design may rely upon personal knowledge of the Examiner and therefore Applicant believes MPEP 2144.03 will apply. Pursuant to MPEP 2144.03, Applicant respectfully requests the Examiner to provide support for his assertion either by an affidavit or by references brought to the Applicant’s attention. Otherwise, Applicants request this rejection be removed. *See, e.g.*, MPEP 2143.01. Applicant submits Justheim ‘689 and ‘982 does not appear to teach all of the features in claim 5081 and the claims dependent thereon.

Applicant submits that many of the dependent claims are independently patentable. Claim 5084 describes a combination of features including: “wherein the heat is provided such that an average temperature in the part of the formation ranges from approximately about 270 °C to about 400 °C.” The above quoted feature of claim 5084, in combination with the other features of the claim, does not appear to be taught or suggested by the cited art.

Claim 5086 describes a combination of features including: “wherein at least one of the heaters is located in a heater well, and wherein at least one of the heater wells comprises a conduit located in the formation, and further comprising heating the conduit by flowing a hot fluid through the conduit.” The above quoted feature of claim 5086, in combination with the other features of the claim, does not appear to be taught or suggested by the cited art.

Claim 5087 describes a combination of features including: “wherein at least some of the heaters are arranged in a triangular pattern.” The above quoted feature of claim 5087, in combination with the other features of the claim, does not appear to be taught or suggested by the